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BOTANY.—*Haitian mosses collected by E. C. Leonard.*[1] R. S. WILLIAMS, New York Botanical Garden. (Communicated by WILLIAM R. MAXON.

The following list enumerates some 75 species of mosses obtained in the Republic of Haiti by E. C. Leonard in November and December 1925 and January and February 1926, at elevations ranging from near sea-level to about 1,200 meters, also two species collected in the Dominican Republic by W. L. Abbott in 1922. About half the specimens were in fruit. A portion were determined by Mrs. E. G. Britton.

FISSIDENS ACICULARIS C. M. Near Marmelade, 800 m., on limestone (8085). Near St. Michel de l'Atalaye, 350 m., on soil (7586). This species has previously been attributed only to Brazil. The specimens are all sterile but seem to belong here.

FISSIDENS GARBERI L. & J. Near Dondon, about 400 m., on roots (8690a).

FISSIDENS KEGELIANUS C. M. Near Port au Prince, about sea-level, on damp soil (10112). This with two exceptions is the only moss collected near sea-level.

FISSIDENS MOLLIS Mitt. Near Caye-la-Croix, about 700 m., on damp soil (7934); det. E. G. B. Near Marmelade, about 800 m. (8190).

DICRANELLA HERMINIERI Besch. Near Plaisance, about 400 m., on clay bank (9367); det E. G. B.

CAMPYLOPUS ANGUSTIRETIS (Aust.) L. & J. Near Marmelade, about 800 m., on rotten stump (8234). This species previously credited only to Florida and fruiting specimens still unknown.

LEUCOBRYUM ANTILLARUM Schp. Near Marmelade, about 800 m., on rotten log (8290) and in thicket (8218). Near Plaisance, about 400 m., on soil (9351); det. E. G. B.

OCTOBLEPHARUM ALBIDUM (L.) Hedw. On rotten log, near St. Michel de l'Atalaye, 350 m. (7486). On tree, near Caye-la-Croix, about 700 m. (7885). On rotten log near Marmelade, about 800 m. (8283).

[1] Received March 17, 1930.

WEISIA VIRIDULA AMBLYODON (Brid.) Bry. Eur. On damp soil near Plaisance, about 400 m. (9704). Appears to be this variety or very near it.

TRICHOSTOMUM JAMAICENSE (Mitt.) Jaeg. On damp walls near Dondon, about 400 m. (8613 and 8629a). Near Ennery, 825–900 m., on earth and damp rock (9028 and 9099); det E. G. B.

HYOPHILA TORTULA (Schwaegr.) Hpe. On limestone soil and rock near St. Michel de l'Atalaye, about 350 m. (7045 and 8466).

BARBULA AGRARIA (Sw.) Brid. On limestone, near St. Michel de l'Atalaye, 350 m. (7120, 7234, 7783); det. E. G. B. Near Dondon, 400 m. (8716b). Near Ennery, 325–900 m. (8945, also 9052); det. E. G. B. All on limestone.

BARBULA CRUGERI Sond. On damp lime-soil, near St. Michel de l'Atalaye, about 350 m. (7042a).

BARBULA SUBULIFOLIA Sull. Near St. Michel de l'Atalaye, on wet rocks, about 350 m. (7805).

TORTELLA CAESPITOSA (Schwaegr.) Limpr. On base of tree near Marmelade, about 800 m. (8337). Near Ennery on stumps, 325–900 m. (9451a).

FUNARIA CALVESCENS Schwaegr. Near Ennery on damp soil, 325–900 m. (9469). On burnt stump, same locality, (9451) and near St. Michel de l' Atalaye about 350 m., on damp wall of limestone (7138).

SPLACHNOBRYUM OBTUSUM (Brid.) C. M. Near St. Michel de l'Atalaye on lime-soil, 350 m. (7044).

BRYUM ANDICOLA Hook. Near Ennery on damp soil, 350–900 m. (9017).

BRYUM CORONATUM Schwaegr. Near St. Michel de l'Atalaye, about 350 m., on rotten wood (8023 and 7508). Near Caye-la-Croix, about 700 m., crevice in coral rock (7966); det. E. G. B.

Bryum leonardi Williams, sp. nov.

Fig. A, 1–6.

Evidently dioicous: growing in dark green, rather loose tufts with weak stems 10–12 mm. long, radiculose below and often bearing very short branches; leaves distant, often decurrent, not imbricate, more or less plicate and much contorted when dry, when moist widely spreading, often slightly recurved, the upper stem-leaves about 1.75 mm. long, broadly obovate, bordered all around and serrulate about one-third the way down; costa in upper leaves mostly slightly excurrent into a short apiculus; lowest stem-leaves mostly very small, obtuse, entire, with costa vanishing well below apex; median leaf-cells more or less hexagonal, from scarcely elongate to about twice longer than wide, up to 12–16μ wide by 25–30μ long, with thin walls, the basal cells becoming rectangular and much longer than those above; leaf-borders slightly browner than within, of mostly about 3 rows of very narrow, elongate cells with walls somewhat thickened; archegonial flowers with outer leaves much like those of upper stem but with longer, narrower base and more numerous rectangular cells, the inner leaves very small, rather lanceolate, more or less serrulate and costate; archegonia 8–10, with 12–15 filiform paraphyses; fruit unknown.

HAITI: Vicinity of Dondon, at about 400 meters, on damp wall, E. C. Leonard, Jan. 7, 1926 (8629b).

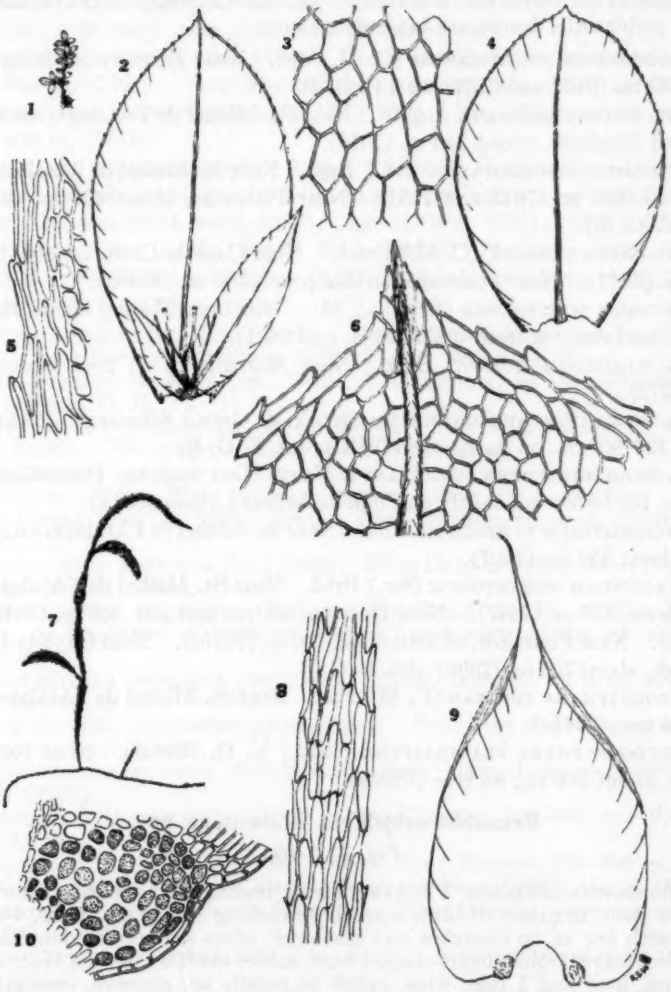

Figure A.—1–6, *Bryum leonardi* Williams, sp. nov. 1, Moistened plant, about natural size. 2, Outer and inner perichaetial leaves, etc., about × 30. 3, Median leaf-cells, × 180. 4, Upper stem-leaf, about × 30. 5, Border one-half way down leaf, × 180. 6, Apex of stem-leaf, × 180. 7–10, *Renauldia subpilifera* Williams, sp. nov. 7, Plant, about natural size. 8, Median leaf-cells, × 280. 9, Upper stem-leaf, about × 180. 10, Alar cells, × 180.

This species seems to be nearest the Brazilian *B. ocdiloma*, but the border is narrower, the leaves are rather larger and more strongly serrulate, and the inner perichaetial leaves are lanceolate-acute.

RHODOBRYUM SWARTZIANUM (C. M.) Par. Near Ennery, on damp soil, 325–900 m. (9122 and 9131); det. E. G. B.

PHILONOTIS GRACILLIMA Ångstr. Near St. Michel de l'Atalaye, on damp soil and limestone, about 350 m. (7018).

PHILONOTIS SPHAERICARPA (Sw.) Brid. Near St. Michel de l'Atalaye, on lime-soil, 350 m. (7043 and 7551). Near Plaisance, about 400 m. (9396); det. E. G. B.

PHILONOTIS TENELLA (C. M.) Besch. Near Caye-la-Croix, on clay-bank, 700 m. (7884). Near Plaisance, on damp soil, 400 m. (9398a).

ERPODIUM DOMINGENSE (Brid.) C. M. Near Gros Morne, about 235 m., on soil and roots of trees (9871, 9883, and 9891).

MACROMITRIUM HUSNOTI Schp. Near Marmelade, on tree, about 800 m. (8372).

MACROMITRIUM MUCRONIFOLIUM (Hook. & Grev.) Schwaegr. Near Ennery, 325–900 m., on damp wood (9133); det. E. G. B.

MACROMITRIUM SCHWANECKEANUM Hpe. Near Laguna, Dominican Republic, 100 to 500 m., chiefly on Pilón de Azúcar (*Abbott* 2331a).

MACROMITRIUM TUMIDULUM Mitt. Near St. Michel de l'Atalaye, on rotten log, about 350 m. (7507).

RHACOPILUM TOMENTOSUM (Sw.) Brid. Near St. Michel de l'Atalaye, on limestone, 350 m. (7487). Near Dondon, on tree and soil, 400 m. (8543 and 8609a). Near Plaisance, on rotten log, 400 m. (9216c). Near Caye-la-Croix, on rock, about 700 m. (7999); det. E. G. B.

ACROCRYPHAEA COFFEAE (C. M.) Par. Near St. Michel de l'Atalaye, 350 m., on tree (7244a).

PSEUDOCRYPHAEA FLAGELLIFERA (Brid.) E. G. Britton. Near Caye-la-Croix, about 700 m., on tree (7899a).

Renauldia subpilifera Williams, sp. nov.

Fig. A, 7–10.

Inflorescence unknown: Plants with wiry, trailing stems bearing a few more or less erect, flexuous, distant, scarcely branching secondary stems, 4–5 cm. long with few or no branches and scattered, often scarcely evident tufts of radicles; leaves from a heart-shaped base, rather short-ovate, the blade about 1.5 mm. long and 1 mm. wide, entire or mostly so, concave, ecostate, the margins above incurved, rather gradually narrowed into a hair-like apiculus up to about one-fifth of length of entire leaf; cells of leaf very uniform to near base, the median about 30μ long and 4–5μ wide, with unequally thickened and slightly pitted walls, the alar cells forming a very distinct, convex, brownish cluster.

DOMINICAN REPUBLIC: Polo, Prov. de Barahona, 600–1200 meters, Feb. 26–March 12, 1922 (*Abbott* 1879c).

Nearest *R. cochlearifolia* of Mexico, but much less branched, the leaves with much longer points, the alar cells forming a more distinct cluster and cells above with much more irregularly thickened walls.

PIREELLA CYMBIFOLIA (Sull.) Card. Near Caye-la-Croix, on shaded rock, about 700 m. (7991). Near Marmelade, in thicket, about 800 m. (8271).

PTEROBRYUM ANGUSTIFOLIUM (C. M.) Mitt. Near Dondon, on shrub, about 400 m. (8744).

PAPILLARIA NIGRESCENS (Sw.) Jaeg. The most abundantly collected of any of the species, growing on both trees and rocks, being represented by 14 packets: Dondon (8544, 8670, 8689); Caye-la-Croix (7871a, 7894); Ennery (9155); Marmelade (8126a, 8268); Pilate (9603); Plaisance (9212, 9230, 9252a, 9257); St. Michel de l'Atalaye (8463). The elevations run from 325 m. at Pilate to 800 m. at Marmelade.

METEORIOPSIS PATULA (Sw.) Broth. Near Marmelade, on shrubs, 800 m. (8383). Near Ennery, 325-900 m. (8994, 9112a); det. E. G. B.

PHYLLOGONIUM FULGENS (Sw.) Brid. Near Ennery, on rock, 325-900 m. (9140); det. E. G. B.

CALYPTOTHECIUM MORITZII (Hpe.) Broth. Near Marmelade, on rock, 800 m. (8280). Not before credited to the West Indies.

NECKEROPSIS UNDULATA (Palis.) Hedw. Near Caye-la-Croix, on tree, about 700 m. (7899). Near Plaisance, on tree, about 400 m. (9256).

PINNATELLA MINUTA (Mitt.) Broth. Near Dondon, on rock, about 400 m. (8702).

CYCLODICTYON ALBICANS (Sw.) Broth. Near Caye-la-Croix, about 700 m., on rock (7880 and 7881).

CALLICOSTELLA COLOMBICA Williams, Bryologist **28**: 61. 1925. Near Ennery, on limestone, 325–900 m. (9024). Specimen sterile but apparently this.

CALLICOSTELLA DEPRESSA (Sw.) Jaeg. Near Plaisance, on rock, 400 m. (9187); det. E. G. B.

CALLICOSTELLA SUBFISSIDENTOIDES Broth. Near Port au Prince, on damp soil, near sea level (10099).

LEPIDOPILUM AMPLIRETE (Sull.) Mitt. Near Marmalade, about 800 m., on rock (8385).

CROSSOMITRIUM SINTENISII C. M. Near Ennery, 325–900 m. (9141); det. E. G. B.

HELICODONTIUM CAPILLARE (Sw.) Jaeg. Near Ennery, 325–900 m., on tree (9548a). Near Plaisance, about 400 m., on tree (9209); det. E. G. B.

HELICODONTIUM TENUIROSTRE Schwaegr. Near Dondon, on rotten wood, about 400 m. (8725).

HAPLODONTIUM MICROPHYLLUM (Sw.) Broth. Near Pilate, on rock, about 325 m. (9632).

THUIDIUM ACUMINATUM Mitt. Near Ennery, on damp bank and stump, 325–900 m. (9132 and 9149); det. E. G. B.

THUIDIUM INVOLVENS (Hedw.) Mitt. Near Marmelade, on rock, about 800 m. (8171). Near Dondon, on rock, about 400 m. (8724).

THUIDIUM URCEOLATUM Lorentz. Near Marmelade, on rock and rotten log, about 800 m. (8274 and 8282).

BRACHYTHECIUM STEREOPOMA (Spruce) Jaeg. Near Dondon, about 400 m., on damp wall (8628). Near Pilate, 325 m., on damp soil (9639).

RHYNCHOSTEGIUM SERRULATUM (Hedw.) Jaeg. Near Ennery, 350–900 m., on rotten log (9001b). Near Dondon, about 400 m. (8609). Near Plaisance, about 400 m. (9253). Near Marmelade, about 800 m. (8091). The last specimen is perhaps a variety of *R. serrulatum*, having broader, shorter-pointed, and more strongly serrulate leaves, with the outer leaves of the flower-buds broadly rounded or very obtuse. It may prove a distinct species.

OXYRRHYNCHIUM CLINOCARPUM (Tayl.) Broth. Near Ennery, on damp banks, 325–900 m. (9535a). The first record for the West Indies.

ERYTHRODONTIUM CYLINDRICAULE (C. M.) C. M. Near Caye-la-Croix, on mango tree, about 700 m. (7894a). Near Ennery 325–900 m. (9523).

ENTODON BEYRICHII (Schwaegr.) C. M. Near Caye-la-Croix, on rock, about 700 m. (7999a); det. E. G. B. Near Ennery, on rock, 325–900 m. (9048); det. E. G. B.

ENTODON MACROPODUS (Hedw.) Mitt. Another abundantly collected moss of this list, growing on rocks and wood: Near Dondon (8669); Ennery (8996); Marmelade (8126, 8174 and 8195); Pilate (9609); Plaisance (9246); St. Michel de l'Atalaye (8467). The elevations range from 325 to 800 meters.

STEREOPHYLLUM CULTELLIFORME (Sull.) Mitt. Near Plaisance, 400 m., on rock (9374); det. E. G. B.

STEREOPHYLLUM LEUCOSTEGUM (Brid.) Mitt. Near St. Michel de l' Atalaye, on trees and rotten wood, about 350 m. (7240, 7259, 7488, 7748, 7749, 7749a, 8023b, 8488 and 8493).

STEREOPHYLLUM RADICULOSUM (Hook.) Mitt. Near Dondon, on tree (8546). Near Plaisance, on tree (9256a). Near St. Michel de l'Atalaye, on rotten wood (7485 and 8023a).

Pilosium serrulatum Williams, sp. nov.

Fig. B

Autoicous, the male flowers with about 4 large antheridia (some 0.35 mm. long) and a few filiform paraphyses, enclosed by rather broadly lanceolate leaves minutely serrulate at apex: plants growing in loose, glossy green mats, the stems (up to 4 cm. high) with few radicles, bearing short, irregularly placed, complanate branches; stem-leaves complanate, ecostate, the lateral spreading-incurved, about 1.5 mm. long and 0.65 mm. wide, not quite symmetric, rather ovate, the apex broadly acute and minutely serrulate; leaves on upper side of stem for the most part slightly smaller and symmetric; leaf-cells elongate to near base, the median very narrow, about 4μ wide by 100μ long or more, the basal cells in lateral leaves broad, 20–25μ wide, more or less rectangular and usually much more numerous on one side of the base than on the other, in the leaves on upper side of stem these basal cells often scarcely present; archegonial flowers with outer leaves short, the rather broadly lanceolate and serrulate apex slightly spreading, the inner leaves twice longer or more, with narrowly lanceolate, serrulate apex mostly somewhat recurved, enclosing 8–10 archegonia with rather few, filiform paraphyses; fruit not known.

HAITI: Vicinity of St. Michel de l'Atalaye, at about 350 meters, on dead wood, Nov. 20, 1925 (*Leonard* 7248).

This species differs from other members of the genus in having the apex of most of the leaves, both of stems and flowers, minutely but sharply serrulate; the perichaetial leaves also are unusually slenderly pointed and the median leaf-cells very narrow.

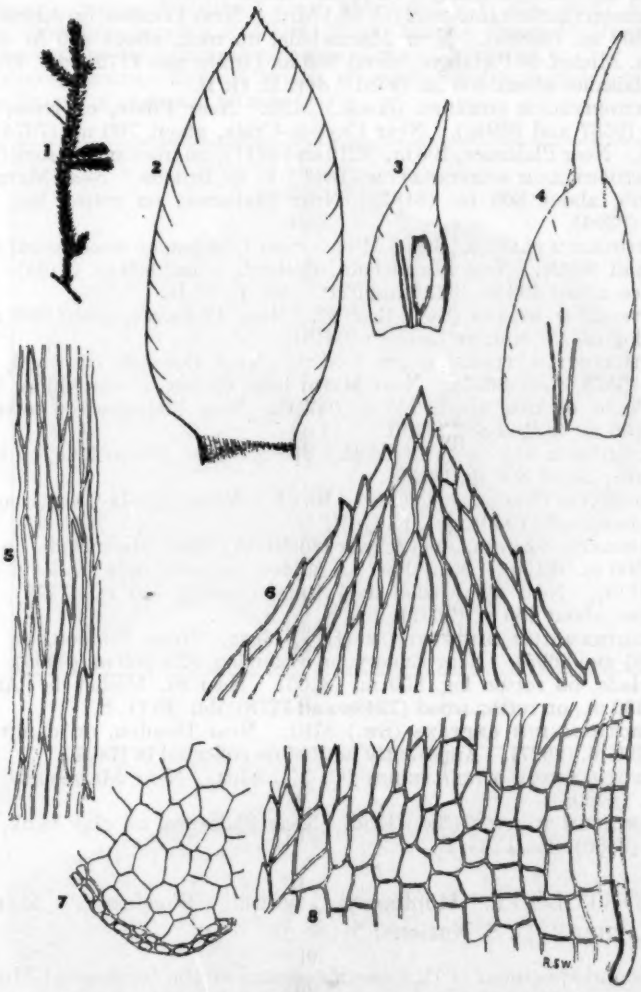

Figure B.—*Pilosium serrulatum* Williams, sp. nov. 1, Plant, about natural size. 2, Stem-leaf, about × 30. 3, Inner perigonial leaf, etc., about × 30. 4, Inner perichaetial leaf, etc., about × 30. 5, Median leaf-cells, × 280. 6, Apex of stem-leaf, × 180. 7, Partial cross-section of stem, × 180. 8, Basal cells about one-half way across leaf, × 180.

SEMATOPHYLLUM ADMISTUM Sull. Near Ennery, 325–900 m., on rotten log (9001) and on tree (9510). Near Marmelade, about 800 m., on shrub (8299). Near St. Michel de l'Atalaye, on palm stumps (8460).

SEMATOPHYLLUM GALIPENSE (C. M.) Mitt. Near Dondon, on rotten wood, about 400 m. (8686b). Near Marmelade, on rock, about 800 m. (8250). Near St. Michel de l'Atalaye, about 350 m. (7624a and 7779); det. E. G. B. Near Plaisance about 400 m. (9381); det. E. G. B.

SEMATOPHYLLUM LOXENSE (Hook.) Mitt. Near Pilate, on trees, about 325 m. (9587 and 9594c). Near Caye-la-Croix, about 700 m. (7974); det. E. G. B. Near Plaisance, 400 m. (9210 and 9211), on trees and on rock (9341).

SEMATOPHYLLUM SUBPINNATUM (Brid.) E. G. Britton. Near Marmelade on shrub, about 800 m. (8185). Near Plaisance, on rotten log, about 400 m. (9304).

TAXITHELIUM PLANUM (Brid.) Mitt. Near Dondon, on wood, about 400 m. (8690 and 8692). Near Marmelade, on shrub, about 800 m. (8164). Near Plaisance, about 400 m. (9224 and 9216); det. E. G. B.

ISOPTERGIUM MICANS (Sw.) R. & C. Near Plaisance, about 400 m., on rotton log (9325), and on bamboo (9413).

ISOPTERYGYIUM TENERUM (Sw.) Mitt. Near Dondon, on wood, about 400 m. (8578, 8685, 8697). Near Marmelade, on tree, about 800 m. (8097). Near Pilate, on tree, about 325 m. (9594). Near Plaisance, on rotten log, about 400 m. (9216a and 9333).

TAXIPHYLLUM PLANISSIMUM (Mitt.) Broth. Near Marmelade, on base of small tree, about 800 m. (8139).

VESICULARIA CRASSICAULIS (Mitt.) Broth. Near Caye-la-Croix, about 700 m., on damp soil (7930); det. E. G. B.

VESICULARIA VESICULARIS (Schwaegr.) Broth. Near Marmelade, on earth, about 800 m. (8150). Near Port au Prince, on rock, near sea-level (10107 and 10110). Near St. Michel de l'Atalaye, about 350 m. (7279). Near Plaisance, about 400 m. (9397); det. E. G. B.

MICROTHAMNIUM DIMINUTIVUM (Hpe.) Jaeg. Near Dondon, on rotten log, 8691 and 8695). Near Ennery, on rotten log, 325–900 m. (9005). Near Marmelade, on rotten log, 800 m. (8265). Near St. Michel de l'Atalaye, about 350 m., on rotten wood (7248a and 7778); det. E. G. B.

MICROTHAMNIUM REPTANS (Sw.) Mitt. Near Dondon, on damp walls, about 400 m. (8627). Apparently not before collected in Haiti.

MICROTHAMNIUM THELISTEGUM (C. M.) Mitt. Near Marmelade, about 800 m. (8269a).

POGONATUM TORTILE (Sw.) Brid. Near Plaisance, on clay bank, about 400 m. (9366); det. E. G. B.

PALEONTOLOGY.—Hoploparia westoni *Woodward*.[1] MARY J. RATHBUN, U. S. National Museum.

A second specimen of this species, found at the Geological Museum, University of Alberta, by Prof. P. S. Warren, has been referred to the author for description. It was collected by Dr. J. O. G. Anderson in Alberta from the Bearpaw shale, 236 feet above the base, L. S. 4, Section 32, Range 22, Township 6, west of the 4th meridian, Catalogue No. 409.

[1] Received March 21, 1930.

Hoploparia westoni Woodward

Figs. 1–3

Hoploparia westoni Woodward, Geol. Mag. [ser. 4] 7: 433, pl. 17, fig. 1 *a*, *b*, *c*. 1900; type-locality, Red Deer River, Alberta, Range 15, Township 23, west of the 4th principal meridian; Upper Cretaceous.

MEASUREMENTS.—Lateral length of carapace (incomplete) 40.2 mm., dorsal length of abdomen 86 mm.

Fig. 1. *Hoploparia westoni*. Left profile.

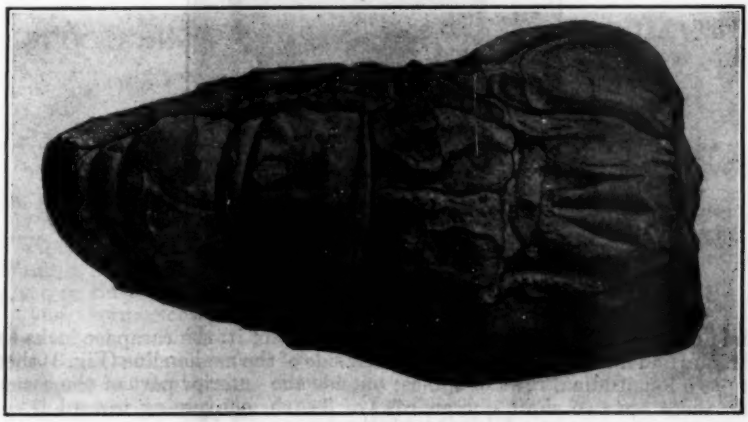

Fig. 2. *Hoploparia westoni*. Dorsal view of posterior end.

A large part of the carapace and abdomen is preserved. The carapace is rough with abundant, conical, acute or subacute spines (mostly broken off) of different sizes, well separated and arranged with only a partial bilateral symmetry. Interspaces smooth or nearly so. The cervical suture is oblique

Fig. 3. *Hoploparia westoni*. Dorsal view of carapace.

and arcuate forward in profile (Fig. 1); in front of it, the carapace lacks the rostrum and hinder median part. Either side of the median line (Fig. 3) there are two longitudinal rows of spines; outside the anterior part of the second row there are two short oblique rows of 3 each, converging toward it. A

slightly elevated ridge seems to terminate in a suborbital spine (Fig. 3 o), while a much stronger, longer and rougher ridge leads to the antennal spine (Fig. 3 a). The cervical suture at its lowest extremity bends forward in a curve subparallel to the lower margin of the carapace; from this curve a deep, irregular nearly transverse groove runs upward to within a short distance of the median line; it has a shallow branch above, and below a deeper one enclosing a triangular, unispinose area (Fig. 1). Behind the cervical suture a broad, shallow, longitudinal furrow with 2 or more distant spines appears to be median; it is bordered by a blunt multispinose ridge which is continued a ways along the posterior margin of the cervical suture. Otherwise the spines of the surface are irregularly scattered. The hinder end of the carapace is missing.

The surface of the first five segments of the abdomen is for the most part smooth (non-tuberculate) and is finely and closely punctate. The fourth and fifth segments have a low, blunt median carina (Fig. 2). The sixth segment has an uneven dorsal surface; its median carina is rough with tubercles, perhaps spine-tipped; on either side just behind the articulation with the preceding segment there is a ridge projecting outward and armed with 5 jointed spinules; further back and nearer the middle are a number of very fine spinules. The pleura (Fig. 1) are separated from the tergum by very uneven ridges; pleura 1, 2, and 6 are longer, in the direction of the axis, than high; while 3, 4, and 5 are higher than long. All are uneven, and rough with tuberculated ridges; 1 is small, short, subtriangular, 2 is broadly rounded, subcircular, 3, 4, and 5 are elongate, subtriangular, more or less falcate, 6 is produced in a triangle in its anterior half. The telson (Fig. 2) is as broad as long, sides arcuate, extremity less so, meeting the lateral margins at an obtuse angle; 5 nearly longitudinal grooves, a deep median one along which the surface is pitted in addition to the fine punctae; on either side another groove convex outward and an outer groove subparallel to the margin. Extremity of telson thin, translucent. The uropods are detached from their base but probably in life do not reach farther back than the telson; the terminal articles are broad-oval; the upper surface of the inner one is concave and there is an indication of a row of spines along the posterior end of the outer half.

Of the appendages a cross-section of perhaps the carpus of the cheliped is exposed, also portions of two slender legs.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY

1002ND MEETING

The 1002nd meeting was held in the Cosmos Club Auditorium, February 15, 1930.

Program: W. F. ROESER: *Thermoelectric pyrometry.* The International Temperature Scale adopted in 1927 by the Seventh General Conference of Weights and Measures was discussed in detail. The full text of this scale is given in Bureau of Standards Journal of Research, vol. 1, No. 4, 1928.

The thermoelectric part of the International Temperature Scale is the fourth such scale used by the Bureau of Standards since 1912. The other three were each described and differences between each of them and the International Scale were given. None of these differences exceed 0.3°C.

The suitability of the copper-silver eutectic alloy was discussed and a value given for it, which is considered good to 0.1°C.

Some difficulties commonly encountered in measuring temperatures were discussed and the conditions stated under which the indicated emf of a number of thermocouples connected in parallel will correspond to the average temperature of the hot junctions.

The general problem of measuring surface temperatures was discussed and two types of contact pyrometers designed and built at the Bureau of Standards were described in detail. (*Author's abstract.*)

Discussed by Messrs. WHITE, TUCKERMAN, and MUELLER.

H. T. WENSEL: *Optical pyrometry.*

There is a limit above which we cannot measure temperatures without employing methods based on the laws of radiation. Various laws available for this purpose, the Stefan-Boltzman law, the Wien Displacement law, and the Wien-Planck Distribution law, were briefly discussed.

The International temperature scale above the melting point of gold is defined by means of the following equation:

$$\frac{1}{\theta} = \frac{1}{1336} + \frac{\lambda \log R}{1.432}$$

Where R is the ratio of brightness at wave-length λ cm. of the radiation from a black body at the melting point of gold (1336°) to the radiation of the same wave-length of a body at the temperature θ°K.

Practical methods of determining R and λ were discussed in detail, and methods of obtaining the value of λ when a filter is used were contrasted with the use of a spectral pyrometer using a dispersion device.

Examples of the precision attainable with a laboratory form of optical pyrometer were given. Bearing in mind that at 1000°K and wave-length 0.65 micron, a precision of 0.1% in the measurement of the ratio of brightness corresponds to a precision of .004% in the absolute temperature, the precision attainable is 0.1° to 0.2° at 1100°C., 0.5° at 1500°C., 1° at 2000°C. and about 5° at 3000°C. The accuracy, of course, depends on other factors than simply the precision of photometric matching and is somewhat less than the figures given. (*Author's abstract.*)

Discussed by Messrs. CRITTENDEN, TUCKERMAN, and WHITE.

Two short informal communications were given by Messrs. WHITE and TUCKERMAN.

1003RD MEETING

The 1003rd meeting was held in the Cosmos Club Auditorium, March 1, 1930. It was called to order at 8:15 P. M. by Vice President Curtis.

Program: L. S. TAYLOR: *Standardization of X-ray dosage.*

In giving X-ray treatments for cancer, it is very necessary to carefully *control* the X-ray dose given the patient just as the doctor must carefully regulate the amount of a drug that he administers. This is particularly important where it is necessary to give the greatest possible dose of X-rays for, should the dose be too great, burns or more serious injuries might result. Likewise it is necessary for the doctors to use some standard dose so that it may be easily duplicated in all parts of the country and all over the world to measure the dose in the same unit, so that their treatments may be reproduced and repeated. At present many doctors use small portable measuring instruments called dosage meters and it is necessary that these be calibrated accurately in the agreed unit. At the Second International Congress of Radiology, held in Stockholm, Sweden, July, 1928, an international unit of X-ray in-

tensity was agreed upon and called the "r" unit. A series of studies at the Bureau of Standards has led to the establishment of the unit in this country. The method of measurement consists essentially in allowing an X-ray beam to pass between two metal plates, one of which is connected to a high voltage battery and the other to a sensitive measuring instrument. The X-rays cause the air between the plates to conduct electricity so that a very small electric current flows through this air and is measured by the sensitive meter. This small current of electricity is proportional to the intensity of the X-rays. Thus an accurate knowledge of the X-ray dose may be obtained by measuring this electric current. Having thus established the standard, the dosage meters used by all doctors can be calibrated at the Bureau of Standards in the accepted unit. (*Author's abstract.*)

Discussed by Messrs. CURTIS, HUMPHREYS, PRIEST and TUCKERMAN.

L. B. TUCKERMAN, S. N. PETRENKO and C. D. JOHNSON: *The strength of metal tubing for structural purposes.*

Hooke's law, "ut tensio sic vis," states that in an elastic structure the stress is proportional to the strain. This law is approximately valid for sufficiently low stresses but for stresses high enough to cause failure in ductile materials, it ceases to be even a rough approximation.

As a consequence the strength of a structure cannot, in general, be related to the strength of a test specimen of the material by the theory of elasticity based on Hooke's law. It is necessary to resort to experiment, using the theory of elasticity merely as a qualitative guide.

The necessity of high strength combined with light weight in aircraft structures has increased the demand for accurate knowledge of the relation between the strength of structural tubing and the specified strength of the material.

In coöperation with the National Advisory Committee for Aeronautics, the Bureau of Aeronautics of the Navy and the manufacturers of structural tubing, the Bureau of Standards has for the past few years, been carrying out an extended series of experiments on the strength of the tubing under combined axial and transverse loads.

The test procedure was outlined and the methods of combining the results into design charts were described.

These methods were partly empirical and partly theoretical, based upon previous work on columns under pure axial load. A full description of the work is given in National Advisory Committee for Aeronautics Technical Note No. 307. (*Authors' abstract.*)

Discussed by Messrs. LIFEROCK, L. H. ADAMS, and HUMPHREYS.

OSCAR S. ADAMS, *Recording Secretary.*

ENTOMOLOGICAL SOCIETY

417TH MEETING

The 417th regular meeting of the Entomological Society of Washington was held at 8 p.m. Thursday, February 6, 1930, in Room 43 of the new building of the U. S. National Museum. Dr. L. O. HOWARD, Honorary President, presided.

Program: FLOYD F. SMITH: *Studies of the black vine weevil.*—The black vine weevil, *Brachyrhinus sulcatus* Fabr., is widely distributed and is occasionally a serious pest of many plants. Although known as a pest of greenhouse plants and of grapes for many years, very little study of the biology and control of this weevil was made until Feytaud carefully observed it for three years in the vineyards of Oleron, France.

The studies reported here by the author extend over a period of three and one-half years—from 1925 to 1929. Observations were made on the life cycle in greenhouses as well as in the nurseries and control experiments were conducted under both situations.

From these studies it is evident that the insect has one annual generation in Pennsylvania. The winter is passed rarely as adults but usually as prepupae or as immature larvae in the soil. The latter begin feeding in March and most of them will reach maturity to pupate with the over-wintering prepupae in May. After about three weeks as pupae the insects transform to adults in the cells and lie inactive for 5 to 10 days during which time the skeleton becomes darkened and hardened. The adults then emerge from the soil in early June and begin to feed on foliage. After four to six weeks, usually in mid-July, they begin to oviposit. The oviposition period usually ends rather abruptly in late August or early September but some eggs may be laid until early October. The eggs laid late in the fall produce larvae which are overtaken by cold weather before attaining full growth. These continue their development in the early spring and may produce adults as late as mid-July. The adults at the end of the oviposition period in the fall seek hibernation quarters and die during the winter except a very few which may emerge the following May. These begin to oviposit in about three weeks and continue, during the second summer, until September. Their early-spring-laid eggs will produce larvae which form prepupal cells in late August and lie inactive until the following spring. A few of these larvae maturing in August may pupate and emerge as adults during the same fall and these will enter hibernation. Out of doors the adults laid from 0 to 488 eggs during the first season. The number varied greatly with the host, fewer eggs being laid by adults confined on strawberry or yellow dock and the greater number by adults confined on primroses or plantain.

The insect may live continually in the greenhouse but probably, in the majority of cases, the adults come into the greenhouse from an outside source and oviposit during July and August. The eggs laid during this period hatch into larvae which mature in November or December as they cut off the roots and burrow into the crowns to the destruction of the host plants which are just coming into bloom for the Christmas market. Should these plants, with the larvae-infested soil, be left on the bench or thrown beneath it as is sometimes done by the florist, the larvae pupate in January or February and emerge about one month later. These adults will begin to oviposit during April or early May on favorable hosts, such as young cyclamen, and continue to lay eggs until September. The adults have laid as many as 1065 eggs during the first season. Normally they seek hibernation quarters, probably outside the greenhouse, and but few emerge in the spring. If confined in cages in the greenhouse these adults will remain sluggish for two or three months but become active and begin to oviposit in December or January. The second period of oviposition usually dwindles during the following midsummer but may continue until September. These adults lived for several weeks after the last eggs were laid and dissection at death showed that no eggs were present in the ovaries. The largest number of eggs laid by a single caged adult in the greenhouse was 1681, and the greatest age of a single adult at death was 816 days. The average number of eggs laid in this series was 1072 and the average age of adults at death was 454 days. The eggs hatch in the greenhouse at extremes of 11 and 22 days, depending upon the temperature, the average being 15–16 days both in and out of doors.

The prepupal stage may be as short as three weeks at warm soil temperatures and has been known to be as long as eight and one-half months at cool temperatures. Pupation did not take place until the soil temperature exceeded 55°F. Soil temperature at 55–65°F. is apparently the optimum for the development of this insect. At higher temperatures the mortality is very high in the prepupal stage; this is due to the attacks of fungi, *Fusarium* sp. and *Isaria* sp. The pupal stage is about 18 days in length with extremes of 16 and 27 days.

The larvae pass through 5 or 6 instars during their period of growth evidently depending upon the abundance of food. Since molting follows a reduction in the amount of available food the number of instars may be increased to 7. The larvae mature in 72 to 110 days in the greenhouse. A few adults were found to emerge in the fall from early-spring-laid eggs. The shortest period of development, from egg hatching to adult emergence, in the greenhouse, was 116 days while out of doors the maximum was 380 days. The maximum life span may then total 1190 days or three and one-quarter years according to these studies.

Usually the florist, being economical with soil, discards the infested plants and dumps both larvae and soil on the compost heap as soon as he notices the decline of the plants. The larvae have been shown to lie dormant in this situation and to pupate and emerge as adults at approximately the same time as do those developing entirely outside. The adults then merely return to the greenhouse and oviposit during July and August to renew the infestation without the necessity of some outdoor host.

The adult oviposits by dropping her eggs wherever she may be, but it is evident that she also occasionally places them in soil or plant crevices.

The larvae during the first 3 or 4 instars feed on the small rootlets and cause no noticeable harm to the plants, but during the later instars growth is rapid and the larvae cut and devour the larger roots and crowns or corms. This accounts for the sudden destruction of the plants which were not suspected of being infested. On woody-stemmed plants the fine rootlets are attacked by the younger larvae but the bark and cambium are devoured by the later stages. Evidence of larval damage to plants in the nursery usually becomes noticeable in April or May while in the greenhouse plants show injury in November or December.

The adults prefer flowers to foliage of a given plant species and will eat out characteristic notches in both. Leaf petioles are also cut and twigs may be girdled. The adults are nocturnal and hide during the day. Their protective coloring blends them into almost any background so that they readily escape observation.

Feytaud found no males in his studies of *B. sulcatus*, but did not prove, by isolation, that parthenogenesis actually occurred. In the present studies the writer has reared, in isolation, 6 generations of this insect and all produced fertile eggs. No males have been found among the thousands of individuals examined externally or among the 1200 adults dissected. Economically this point is important since the reproductive potential is thus increased in geometrical proportions.

Few parasites or predators have been recorded for this insect. The writer found that skunks, mice, and toads ate the adults. Larvae of a ground beetle (*Harpalus caliginosus*) were found attacking the larvae of *B. sulcatus* and readily devoured 2 to 4 larvae per day when supplied with them in confinement. The fungi, *Fusarium* sp. and *Isaria* sp. attack the larvae in the greenhouse, especially during the summer months when the soil temperature is high.

Literature contains many notes suggesting materials for control of *B. sulcatus* either in the adult or immature stages. These materials were tested in the present studies and nearly all were found to be ineffective against the insect at dilutions sublethal to the host plants. From the control studies it was found that the mixing of powdered acid lead arsenate in the soil was the only material which proved toxic to the larvae and unharmful to the host plants—cyclamen and primroses. Other plants were found to be severely injured by small quantities of lead arsenate in the soil so that the general use of this material as a soil insecticide can not be advised. To be effective one ounce of this material to one bushel of potting soil should be used. The amount was not found harmful to the cyclamens and primroses, the usual host plants in the United States.

A sweetened, poisoned bran bait, previously recommended for related weevils, was found to be effective against the adult *B. sulcatus* weevils and is preferable to any other material tested if the staining of foliage is objectionable. If not objectionable a dust composed of equal parts of calcium arsenate and of hydrated lime may be used and gives a slightly higher kill than does the bran bait in tests on *Taxus* in the nursery. Probably the bran bait should be used in the greenhouse and the dust in the nursery.

In these studies tests were made to check on as many host plants as were available. The results point to the probability that *B. sulcatus* has sometimes been confused with other insects, especially the Fuller's rose beetle (*Pantomorus godmani*) and other species of the genus *Brachyrhinus*. The black vine weevil is evidently not a grass feeder, as has been previously suggested, but thrives on several of our grass-infesting weeds such as docks, sorrel (*Rumex* spp.), dandelion (*Taraxicum* spp.), and plaintain (*Plantago* spp.). These plants are sufficiently common to be a potential source of an infestation about any greenhouse and should be eliminated.

The digestive and nervous systems of the larvae and adult, and the reproductive systems of the adult female were discussed. (*Author's abstract.*)

A number of slides were shown. This paper was discussed by HOWARD, BÖVING, WOOD, ROHWER, SPRESSARD, POOS, and CAMPBELL.

Remarks were made on invitation by a visitor, Dr. FRANK E. LUTZ, Curator of Insects of the Division of Zoology and Zoögeography of the American Museum of Natural History, New York City, who expressed pleasure at being with us, extended greetings from the New York Entomological Society and an invitation to our membership to attend its sessions on the first and third Tuesdays of each month. He also discussed in some detail observations he had recently made on one of the New York "movietone" production companies in making commercial records of the chirping of crickets, and illustrated his remarks by blackboard diagrams of methods of calculating the pitch of a cricket's tone and making comparative analysis of this with vibrations per second of an ordinary piano.

Another visitor, Professor H. J. REINHARD of the A. & M. College of Texas, also was asked to address the society. He referred briefly to some special research work he was conducting in the Museum with Doctor ALDRICH on the Tachinidae genus, *Winthemia*, and discussed some of the variations in local problems between entomologists in widely separated sections of the country. He invited all the membership of the society in travel status in Texas to visit his station.

Professor JOHN GRAY, Professor of Plant Pathology and Economic Entomology of the College of Agriculture and Agricultural Experiment Station of the University of Florida, a visitor, on invitation addressed the society,

referred humorously to recent tourist conditions in Florida, and outlined briefly the organization and work of the various scientific organizations in his State. He expressed pleasure at the opportunity to visit Washington and its scientific organizations as he used every opportunity to learn more about what Government and State men are doing. Many of his students expect later on to enter upon Government or State work, and unless properly guided, often have a hard time of it getting started.

L. O. HOWARD spoke briefly of the lives of F. W. HUTTON, THOMAS BROWN and W. M. MASKELL, prominent New Zealand entomologists of the last century. Their lives, he pointed out, were strangely coincidental in some respects.

Some remarks were made by Dr. W. V. BALDUF regarding a recent article by A. HÄSE, which contains an account of the use of a mite (*Tyroglyphus siro*) in manufacture of a cheese, *Milbenkäse*, in Lautenburg, Germany. The curd of cow's milk is shaped into form resembling an O'Henry candy bar; it is dried in the open air, then placed in a jar containing a culture of the above mite. The mites consume the surface superficially, leaving a flaky cover consisting, beside cheese particles, of mite exuviae and mite castings and bodies. After 6 to 12 weeks the cheese is eaten, with the mites intact or after jarring some of them off. Sometimes pathogenic effects are produced in persons eating too much for the first time. Molds do not develop on this cheese, and it is believed that the mites are in some way responsible for failure of the mold to grow. The absence of mold where mites occur is believed by the author to be the reason why mites came to be employed in the manufacture of this cheese. (*Author's abstract.*)

R. E. SNODGRASS submitted a brief note regarding certain functions of the beak of scale insects and compared their mouth parts with those of some other Hemiptera.

Mr. ROHWER called attention to the recent infestation of the pink bollworm in the Salt River Valley in Arizona, stating that since the initial discovery of the infestation, which was called to the society's attention at the November meeting, the infested area had been delimited and arrangements were being perfected to clean up the fields. In connection with delimiting the infested area, all the cotton-producing regions in Arizona and California had been carefully scouted. As a result of this survey, it is believed that the present infestation is confined to that portion of Salt River Valley east of Tempe and to a small area on the Indian Reservation near Sacaton. Infestation has been discovered at twenty-five different points in the Salt River Valley and is heaviest in the eastern portion of the valley. In this area 45 per cent of the bolls in some fields were infested.

The non-cotton zone which has been established by the State contains 144,400 acres and extends two miles from the outermost points of infestation. Within the non-cotton zone there are about 35,000 acres which, for the crop of 1929, were planted to cotton. The non-cotton zone is surrounded by a protective, or buffer, zone which extends three miles beyond the non-cotton zone. In this buffer zone restrictions are placed on the date when cotton can be planted. For the crop of 1930, pima, or long stable cotton, can not be planted before April 1. Acala and other of the shorter staple varieties can not be planted before April 15.

The menace this infestation presents to other cotton-producing regions in Arizona and California, as well as the danger of infestation to the main cotton belt of the east, prompted the Department to request funds to undertake clean-up of the cotton fields throughout the non-cotton zone and in

some parts of the buffer area. A joint resolution appropriating $587,500 for such clean-up passed the Senate today. In addition to this appropriation, the act authorizing Federal participation in compensating farmers, for actual and necessary losses because of the enforced non-production of cotton, has been amended by both the House and the Senate. The amendment reduces the amount of the appropriation authorized and provides full Federal compensation for the crop of 1930, conditioned on the Federal Treasury being reimbursed for one-half of the amount paid. It is hoped that this appropriation for clean-up and the proposed arrangements for compensation for the crop of 1930 will enable the Department to carry out its program and eradicate the pink bollworm from the Salt River Valley.

Mr. ROHWER also referred to previous work on this pest, pointing out that it had been eradicated from considerable areas in eastern Texas and Louisiana. (*Author's abstract.*)

J. S. WADE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

Dr. ALEXANDER WETMORE, Assistant Secretary of the Smithsonian Institution, in charge of the National Museum, has been elected an honorary member of the Deutsche Ornithologische Gesellschaft.

H. G. FERGUSON and M. I. GOLDMAN have been appointed assistant secretaries of the Sixteenth International Geological Congress, which will be held in the United States in 1932.

Dr. REMINGTON KELLOGG, Assistant Curator, Division of Mammals of the National Museum, is spending two or three months in an examination of the types of fossil cetaceans in various European museums.

M. W. STIRLING, Chief of the Bureau of American Ethnology, recently returned to Washington from Florida, where he excavated a large shell mound near Safety Harbor. He obtained a large amount of skeletal material as well as a good collection of objects representative of the culture of the period.

Miss FRANCES DENSMORE, a collaborator of the Bureau of American Ethnology, is spending several weeks in Washington in connection with her studies of the music of the indians.

Miss JULIA GARDNER has resumed field work on the Tertiary formations of Texas in connection with the proposed geologic map of the State.

Dr. L. W. STEPHENSON, who is working on the Cretaceous formations near Uvalde, Texas, will return to Washington the latter part of May.

Obituary

HILBERT A. C. JENISON

Early in the morning of his birthday, February 28, HILBERT A. C. JENISON, mining geologist and engineer, for some years a member of the U. S. Geological Survey, died at his apartment in New York.

Of distinguished Irish descent on his mother's (CAULFIELD) side and of Danish ancestory on his father's side, and with high military records in both families, JENISON was a native of San Francisco. Due to lack of financial resources, much of his education was received at home under guidance of intelligent parents. Meager opportunities were, however, compensated by very unusual precocity and brilliancy of mind. He was far ahead of his school fellows and was most comprehensive in his early reading, with a distinct preference for history and biography. After four and one-half years in the public schools he entered Mount Tamalpais Military School, where he was a student for three years, during which he made an outstanding record.

In his personnel record he is entered as having studied at the University of Washington for two years, and in the following two years at the University of California, where he showed brilliant ability in mathematics and mining geology, though he left the University without thesis and graduation.

Ardently patriotic, he enlisted as a volunteer when the United States entered the World War, and at its close he left the Army slightly disabled and sought a position in the U. S. Geological Survey, in which he was appointed Associate Mineral Geographer in the summer of 1919. In 1921 he was appointed geologist.

While a member of the geologic staff of the Survey (September 23, 1919 to November 27, 1923) Captain JENISON was engaged first in gathering information regarding the copper resources of the Americas and, with D. F. HEWETT, in the compilation of the statistics of production of manganese. Later he took over from B. S. BUTLER the preparation of the annual mineral resources reports covering copper, and this opened the way to a compilation and review of the information regarding world resources of copper, on which a somewhat extensive manuscript was compiled. For this work he was especially well fitted, due to his remarkable memory, keenness of mind, and power of concentration, combined with a marked interest in the economics of the mineral industry. Due to the latter he was, in 1923, prior to his resignation, detailed to coöperate with the Chairman of the Senate Committee on Mines and Mining in the study of the cost of production of silver and its associated metals in the western States.

For a short time after severing his connection with the Survey, Captain JENISON was occupied with commercial examinations of manganese and other metalliferous deposits in North America, in the course of which he was appointed mining specialist on the staff of the Guaranty Trust Company of New York, for which he examined many mining properties in several countries of Europe as well as in the United States.

In 1921 Captain JENISON married Miss LOREE O'CONNELL, a graduate of the University of Nebraska. She, together with his parents and a sister, resident in California, survive him. Captain JENISON was buried in Arlington National Cemetery March 3, 1930.

DAVID WHITE.

CLAUDE ELLSWORTH SIEBENTHAL

Dr. CLAUDE ELLSWORTH SIEBENTHAL, specialist on lead and zinc for the U. S. Geological Survey, died at Daytona Beach, Florida on March 1 after a long illness.

Both as geologist and economist Doctor SIEBENTHAL received wide recognition as an authority on lead and zinc. Born at Vevay, Ind., April 16, 1869, a descendent of JOHN FRANCIS de SIEBENTHAL, a founder of Vevay and Switzer-

land County, Ind. (1801), he studied at Indiana University (1889–1891), was graduated from Stanford University in 1892, and received the degree of A.M. there in 1893. From 1889–1893 he also served as assistant geologist on the Arkansas Geological Survey under Dr. JOHN C. BRANNER, later President of Stanford. He then returned to Indiana, serving on the State Geological Survey until 1897, where with T. C. HOPKINS he prepared a report on the Indiana oolitic limestone. He was a fellow at the University of Chicago 1897–1901.

He joined the U. S. Geological Survey in 1901 and after several seasons devoted to studies of ground waters in Wyoming and Colorado was transferred to the mineral fields of the Mississippi Valley. In 1907 he was placed in charge of investigations relating to lead and zinc and in 1915 published his classical report on the origin of the lead and zinc deposits of the Joplin district. From 1907 until 1924 he was responsible for the Survey's annual reports on lead and zinc and contributed several articles to the technical press and the Zinc Institute on the economics of those metals.

He was a member of the Geological Society of America, the American Institute of Mining and Metallurgical Engineers, local scientific societies, and the Cosmos Club.

Doctor SIEBENTHAL was an effective influence for the best in human relations, through the manifestation of his genuine interest in his fellows generally, and particularly in those afflicted by illness or adversity. He was distinguished among his friends for an innate gentleness and courtesy, and a keen sense of humor which continually enlivened his conversation.

In 1904 he was married to Miss MYRTLE MADDEN of Olney, Ill., who, with his sister, survives him.